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Problems of methodology and method in climate and energy research: Socialising climate change?

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A B S T R A C T

The article introduces a Special Issue on problems of methodology and method in climate and energy research. It charts the urgent and growing focus on 'socialising' emission reduction and climate stability into energy policy. This decarbonisation agenda is read as an exercise of 'purposive' climate agency, designed to achieve climate stability. Contributors to the Special Issue focus on the challenges this poses for energy research, in terms of methodology and method. The articles are grouped across seven key themes: 1) problems of knowledge production; 2) researching norms and ideologies; 3) grappling with inter-disciplinarity and multiple methods; 4) exploring energy culture and behaviour; 5) comparative and multilevel studies; 6) temporal and longitudinal studies; and 7) participatory and action research. The themes and results are debated in terms of cross-cutting problems and possibilities for future investigation into how to socialise climate into energy (and vice versa).

1. Introduction

This Special Issue focuses on problems of method, in social research on climate change and energy use and organisation. By 'method' we mean the procedures involved in collecting data or conducting research. We are, in the first instance, interested in gaining insights into the problems of 'how' we might go about research, rather than in the 'object' of research, although questions of method necessarily reflect the object of study and how it is theorised, or formally understood. In the situation of climate change, contributors to this issue address the micro-level questions and dilemmas that arise from undertaking energy research in order to shed light on the wider issues and problems. In this respect we reversed the lens, asking our participants to start with the direct experience of undertaking research into social aspects of energy and/or climate, and then to use that experience to gain an insight into the wider problems of method and material. We deliberately kept the proposal open to people from many disciplines, and did not limit the methods of research which could be discussed, or the forms of methodology deployed, except to say that we regard 'methodology' as the study of how we come to know things through various methods, and 'method' as concerning the tools we use to know things [1]. We did not even enforce that distinction. Participants have been asked to focus on some of the following: the 'tools' that they use to extract data and make analyses; their understanding of epistemological processes; their approach to the situation they find themselves in; the kinds of theories

they are interested in; the effects of disciplinary boundaries; and/or questions of how the research objects, or contexts, problematize their ways of doing research and the questions being asked. The contributors found many other significant issues, several of which are prefaced here.

In this introductory article we aim to draw-out some common themes across the articles, offering some means of navigating the contributions. We begin with discussing general issues of method and methodology and their importance in addressing the various difficulties we encounter in researching energy and climate change. Then, in the next section, we provide a detailed summary of the Special Issue, as organised into seven broad themes. In the third section we provide a synthesis of overarching issues and methodological requirements for bringing climate and energy research together. We conclude by discussing how the methodological considerations debated here may open-up pathways for new forms of research.

1.1. The importance of method and methodology

Every researcher will at some time have problems with methodology and with the relation between method and theory. There is probably no methodology which does not express some theory about the nature of the world and the way it works, and theories usually imply some kind of method to provide them with relevant and useful data. The history of science is full of people discovering problems with methods, or developing new technologies or theoretical frameworks

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that highlight previous problems of method and methodology. This is one way of looking at Kuhn's [2] distinction between 'normal' and 'revolutionary' science. In normal science problems of methodology seem less significant than knowledge advancement; the problems are essentially ignored or explained away, as exceptions to the general paradigm. This holds for the sciences as much as for the social sciences. For example, learning to use telescopes alters people's relations to the heavens, the ways they make relevant observations, and their theories of what is being observed. Einstein's general theory of relativity, drew attention to, and explained, variations in the orbits of Mercury which tended to be passed over by scientists using the Newtonian system.

One possible reason for being able to ignore problems of method is that when the world and researchers' theories are stable, normal science is relatively easy, highly productive and valued by the community of the discipline. However, under conditions of climate change and ecological despoliation, this stability is less available. With the passing of time the total climate and ecological situation gets even more socially disruptive, and pressures build. In this situation, systems, whether sociological, ecological or geological are changing, and we may continually need new ideas and new forms of research to make sense of what is happening. In such situations of high-level and rapid change, problems with method come to the fore, and have the potential to provide some enlightenment about the subjects being studied (Picture 1).

1.2. Socialising climate into energy

Climate change certainly poses profound questions for energy research. Social processes, rooted in the prevailing models of capitalist accumulation, development, and energy production and usage, are altering the world's ecology. Awareness and apprehension of the impacts has produced new forms of 'purposeful' climate agency, centering on energy policy [3]. This signals a 'socialization' process (see Ref. [4]), where climate change is explicitly internalized into social relations, and thereby into policy. Since at least 1990, with the formation of the Intergovernmental Panel on Climate Change (IPCC), governments have acted in response to knowledge of the likely causes and consequences of climate change. In this, they have exercised a form of climate agency, whether or not they resolve to initiate energy decarbonisation or advance the fossil fuel sector.

Today, action at the scale and scope required for a relatively stable climate, is fast becoming the meta-challenge of our age. Fossil fuel energy is the prime driver of growing emissions, accounting for two-thirds of human-generated Green House Gas emissions [5]:20. Increasingly, the climate change 'side-effect' of energy production is becoming the main effect, negating the premise that expanded fossil fuel extraction and burning produces growth and prosperity. With continued emissions growth, the crisis has cascaded outwards into widening social fields. This growing disruption cannot be managed or repressed beyond the immediate short term, and constantly forces new fields and questions onto the agenda.

The challenges of exercising 'purposeful' climate agency in energy lies at the centre of this Energy Research & Social Science (ERSS) Special Issue. In one way or another, all submissions wrestle with the methodological challenges of 'climatising' energy. Implicit in the papers is not only the problem of methods in the social study of energy, but also the urgent necessity of drastically reducing greenhouse gas emissions from energy in the context of continued and persistent fossil fuel dependency. The two agendas are correlated: the challenge to overcome barriers to energy decarbonisation forces a new focus on the wider social relations of energy, calling forth the need for new approaches. This Special Issue aims to advance both agendas, although admittedly in a necessarily incomplete and happenstance fashion. The scope of the problem is huge, and the possible research methods to address it are manifold; while this Special Issue only scratches the surface, it is the first of its kind. However, a driving normative commitment to enabling decarbonisation unifies the papers, along with an intellectual modesty, recognising that answers are not easily attainable.

Picture 1. 'Conveyor Bridge, Jaenschwalde Coal Mine, Germany' Image Credit Lothar Michael Peter.

As is evident from continued emissions growth, existing approaches are inadequate, and their failure requires new methods, reflexivity and critique, to advance the field and take-up the challenges.

Even this is a tall order. The scope of the problem is difficult to apprehend from within the established frameworks of social science research. Deep disputes over what drives the crisis, and thus how to solve it are reflected in debates over naming. Climate change is often positioned as an aspect of the 'Anthropocene', as a distinctly anthropogenic geological era. However, even the idea of the Anthropocene reveals the politics and uncertainties of the field, with many writers rejecting the notion that humanity-in-general, 'the anthropos', is the key driver of change. Alternative ways of characterising the epoch, express contending interpretations as to the 'true culprit' – capitalism itself, the 'capitalocene' or 'neoliberalocene,' the plantationocene, technocene, chthulucene, anthrobscene, to name a few [6–8]. The obvious problem with the name 'Anthropocene', and indeed with the idea of 'Anthropogenic' climate change, is that not all humans have contributed to the problem equally (if at all). It is not caused by 'humanity', but by forms of social organisation and energy production, historically developed under capitalism (although capitalism may not be the only cause). Struggle over dates for the beginning of the epoch are also meshed into the politics of interpretation – partly because no other geological epoch can be dated with this kind of precision. While the idea, and boundaries, of the Anthropocene are (by definition) driven by human action, we can agree that it is an era in which some human social, political and technological processes are altering the world's ecology to the extent that the change will be visible through geological ages. The idea of the Anthropocene remains useful as a provocation, it also is useful as it points to multiple global, socio-ecological 'crises' (not just climate change) and how they may interrelate.

The key question is how society can change to reflect our collective dependence on climate stability. As Dipesh Chakrabarty argues [9], the collision between climate history and social history creates profound intellectual disjunctures. Just as prevailing capitalist and developmentalist society remake climate, so the resulting climate change remakes society. 'Nature' and 'Society' cannot be separated; one produces the other. Social and ecological relations, previously repressed into a society/nature dualism or dialectic, are forced into a new and necessary 'multi-logue' involving many different factors and academic disciplines. In the social sciences, the effect spills across methodological and epistemological questions, into new inter-disciplinary formations and collaborations, widening the scope for analysis and explanation.

While we can easily affirm that 'the social' hinges on the ecological (understood through scientific, technological, and psychological circumstances), the question remains of 'how can we create the means to understand and act on those circumstances?' Certainly, the Special Issue highlights some important avenues to be taken-up. The challenge we face, of an emerging new kind of climate-changed society, has some historical parallels that can help inform interpretation. The social sciences have previously wrestled with the challenges of conceptualising social transformations and charting agency. We would suggest, in fact, that the status and epistemological foundation of the social sciences rests on the assumption that is it possible and necessary to research society in order to act on it. The scale and challenge of industrial capitalism, the advent of colonial imperialism, the apprehension of genocidal fascism, or the utopian urge, have all presented profound challenges for socially-reflexive research and action.

As Mills argued, researchers not only have the capacity but the responsibility to exercise what he called the 'sociological imagination', to offer structural explanations of everyday problems, and to connect social analysis with experience, enabling social reform [10]. We can now point to the 'socio-ecological imagination' as necessary to the process of addressing questions of climate, energy and social formation [11]. The production, politics, organisation, technology and waste of energy are at the centre of the growing maelstrom of climate change. We can no longer, even in theory, isolate the study of energy from its socio-ecological contexts and feedbacks. Energy and society are interlinked in new ways through climate change, and through other ecological crises – we are not wanting to imply that climate change is the only serious ecological disruption resulting energy use, though climate change is intimately tied in with energy generation and has become the exemplar of such crises. Energy research capable of addressing this nexus is urgently needed, and this requires methods and methodology that can meet the challenge.

The Special Issue demonstrates that energy research, and its problems of method, now occupy a critical place in both apprehending and meeting the challenges of climate change. It also demonstrates the centrality of engaged on-the-ground investigation, linked to sustained reflection on method and methodology, to address the challenges of energy decarbonisation. We are in new theoretical and intellectual territory, where results are unexpected and research is genuinely aimed at 'discovery'. This is clearly what motivates many who have been attracted to this field. As Sovacool et al remark, 'research questions need to be asked in such a way that you can be wrong (and that you know when you are wrong) or even surprised'.

This focus reflects the explicit agenda of *Energy Research & Social Science*. A broad concern to bring climate and energy concerns together has informed much of the scholarship in the journal since it was founded in 2014. In the Journal's Opening Issue Benjamin Sovacool [12] wrote: "Social science related disciplines, methods, concepts, and topics remain underutilized, and perhaps underappreciated, in contemporary energy studies research." In the same issue Andy Stirling stated that, with the "transformation away from fossil fuel infrastructures", energy studies "stands most momentously at a historic 'crossroads'" [13]:83. Papers in the opening issue and later have stressed the necessity for energy research both to become more interconnected with the social sciences, and to pay attention to ecological contexts. Later debate has focused on questions around the proper object of study in the context of widespread politico-social transformations in energy regimes, especially given climate change. There has been less attention to related questions of method: in fact only two articles in the journal refer to method in their titles.

While ERSS and journals like it have successfully shifted the agenda to focus on the socio-political questions central to energy transitions, it is not so clear what this means for the methods involved. The only special issue of a journal on method in researching society and climate change that we are aware of is *Contemporary Social Science* 9(4) 2014. This focuses on metaphysical and ontological issues rather than points of practice, even though most of the case studies concerned policy implementation and problems of large-scale measurement. There was little interest in energy issues (despite their centrality), on the problems of different levels of analysis, or of day-to-day life in climate and energy systems. The focuses of this special issue, puts it at the forefront the research agenda (Picture 2).

2. Detailed contents and key themes

The thirty-one papers in this Special Issue have been grouped across seven main themes. We begin with the more abstract, moving to the more concrete and engaged. As noted, all authors have focused on the question of how to bring climate concerns into energy policy, across almost the full range of social science approaches and methods. The themes organising the contents demonstrate this, in moving from researching questions of knowledge production, to researching norms and their consequences for knowledge, working across disciplines and methods, addressing cultural meaning and behaviour, using comparative approaches, mapping issues over time and, finally, deploying action research to directly advance participation and practice. In this section, we briefly summarise the articles as they appear within this thematic structure.

Summary of Approaches in the Special Issue

Picture 2. Signpost to Power Workers Residence: Korba, India. Tom Morton credit.

Addressing climate and energy	Research strategy	Theme in the Special Issue
(i) Addressing an emerging process	Seeking a meta-frame to encompass a developing and emerging field	Theme 1. Problems of knowledge production
(ii) Researching underlying norms and assumptions	Surveying and discourse analysis where norms are defined or contested	Theme 2. Researching norms and ideologies
(ii) Establishing socio-ecological scope	Enable breadth *via* inter-disciplinarity, transdisciplinarity or multi-method research.	Theme 3. Grappling with interdisciplinarity and multiple methods
(iv) Accessing direct experience	Ethnographic, psychological and behavioral approaches; qualitative and quantitative research.	Theme 4. Exploring energy culture and behaviour
(v) Attending to local-global context, reach and disjunctures	Multilevel analysis, scaling research; comparative research on different or convergent responses	Theme 5. Comparative and multilevel studies
vi) Addressing the changing temporal context	Project cycle, longitudinal or inter-generational models	Theme 6. Temporal and longitudinal studies
(vii) Embedding research in practice	Action research for transition/community based science or democracy	Theme 7: Participation and Action Research

2.1. Theme 1: problems of knowledge production

Sovacool et al. [14] open the Special Issue, providing an overview focusing on the key issue of formulating challenging research questions, and developing methods of sufficient scope to answer these questions. The authors offer suggestions on how to deepen engagement with theory while designing research that does not privilege particular kinds of data, but instead seeks to diversify sources, triangulate methods and correlate different data. Their concern is to address the societal scope of the problems, and produce multi-method, comparative, inter-disciplinary and applied research to advance both theory and practice. Much of this Special Issue is dedicated to exactly these agendas, and to elucidating the problems that people encounter with methods. Glueck's paper [15] on 'making energy cultures visible' goes to the question of how the policy field is interpreted, and therefore what is made visible by our analysis. She seeks a greater openness, using 'situational analysis' to produce speculative mappings of players and issues, and how they relate to constitute the field. Method necessarily privileges and excludes various social actors, and needs to be self-conscious of this problem. The role of research is to make sense of the context, but to do so from an awareness of how it could be read differently, and pick up, if possible, silenced actors. Read reflexively, the research process she describes should allow researchers to debate their own 'practices of simplification'. Walker and Johnson [16] offer a different approach to the same question of knowledge production. They use historical evidence to argue for a way of characterising the appropriation and distribution of hydrocarbons and other strategic minerals, by investigating the close relation between 'power' as energy and 'power' as sovereignty. This very usefully questions the prevailing assumption that state policy can be autonomous of energy interests. Edwards [17] also explores the limited autonomy of knowledge, focusing on expert scientists in the energy knowledge complex, investigating how public debates can frame and affect the type of work they do. The research focuses on scientists engaged with hydraulic fracturing, and finds that by attempting to frame themselves as neutral, so as to be credible and legitimate in public discourse, scientists generally assume less critical perspectives, as problem solvers for the oil and gas companies, while assuming fossil

fuel energy has social benefit. This delivers some degree of normative stability against public disquiet. The author reveals the assumptions and values embedded in the science and illustrates the problems the social sciences can face in challenging these fields of framing. Bhushan [48] propose a method of "graphical causal models" to try and overcome the general difficulties faced in doing randomised control trials and proposing causal pathways for household energy saving behaviours.

2.2. Theme 2: researching norms and ideologies

Several papers are primarily concerned with researching social norms and political preferences, and their effects on knowledge and social action. Sahakian and Bertho [18] take this question into the context of household energy preferences, exploring how normative commitments to changed energy use are defined through interactions among household members, and how this affects energy use. Rather than assuming individual autonomy, they explore how face-to-face social relations affect energy practices. In doing so, they theorise the role of emotions, as reflected in inter-personal interactions and socio-technical outcomes. At a more meso level, Zaunbrecher et al. [19] address the issue of norms and preferences by researching local 'social acceptance' of different energy scenarios. Scenarios can integrate a range of aspects, social and ecological, and help reveal contrasting priorities, across livelihood, wellbeing, culture and environment. They show the importance of providing a thorough ecological basis for social acceptance analyses. Nash et al. [20] also address future scenarios, in terms of indigenous peoples' perceptions and responses to climate impacts and adaptation. Their research bridges geo-spatial quantitative methods and ethnographic engagement in a place-defined community, and their objective is to establish deeper practical understanding of 'baseline' data', to allow the development of future climate adaptation strategies. Marshall [21] takes the production of knowledge into the national political context. He addresses the ways in which eight epistemological and methodological problems for energy research interact with the normative political commitments of State inquiries. His analysis centres on a parliamentary inquiry into the social effects of wind power, finding a confluence of players apparently wedded to the visions of fossil fuel interests, with local-level alienation from the implementation of wind projects, in antagonism with advocates for energy transition. He analyses especially how norms and epistemological problems may be deployed to shape debate, generate ignorance and blind spots, within a situation of psycho-social disruption. In this context, certainties and uncertainties are asserted and mobilised as a political resource.

2.3. Theme 3: grappling with interdisciplinarity and multiple methods

Many of the papers in the Special Issue seek to bridge disciplines and methods. This reflects the multi-dimensional character of energy transition, as a socio-ecological, socio-technical and socio-political process. Morton and Mueller [22] engage in a dialogue putting the disciplines of anthropology and journalism in productive tension. Bridging science and sociology is a particular concern for King et al. [23], who examine French efforts to transform soils into carbon sinks. Soil science is thereby enlisted to the emissions-reduction effort, displacing other ways of interacting with or cultivating soil. The authors highlight the benefits of collaboration across widely different disciplines to reveal the ecological agency of soil. They show how this delimits officially promoted possibilities of carbon sequestration. Heaslip and Fahy [24] seek to bridge the engineering and sociological dimensions of energy transition through a community-based planning process for energy transition. Again, scenarios are used to integrate technical and social aspects and to generate a debate about community priorities for energy futures. Scherhaufer et al. [25] discuss how to integrate scientific and engineering concerns with social issues in researching the social acceptance of imagined wind energy projects. They

seek a participatory approach that spans both stakeholders and community representatives. Montedonico et al. [26] outline a 'co-construction' approach to inter-disciplinarity, also across engineering and sociology. They develop concrete methodologies and best practice models for socio-technical energy projects, and report on how these were used for energy technology transfer in Chile. Their approach points especially to a 'science democracy' for energy transitions, where for instance, communities are directly engaged in defining future energy agendas for their localities. Thomas et al. [27] discuss the challenges of an inter-disciplinary action research project designed to enable renewables take-up in remote parts of Indonesia. The authors reflect at length on the problems encountered – across disciplines and with communities, to develop a holistic analysis. Their article outlines key findings in terms of the disjuncture between government and community energy priorities, especially in terms of livelihood, and arrives at a series of key lessons for other research teams aiming to work on such projects.

2.4. Theme 4: exploring energy culture and behaviour

A number of papers focus on the cultural meaning of energy and how it affects behaviour. This 'cultures of energy' approach generally directs researchers to more qualitative investigations using various ethnographic and interview-based approaches designed to draw-out and explore underlying socio-cultural assumptions associated with energy transitions. Espig and de Rijke [28] question the use of multi-sited ethnography to understand the emergence of coal seam gas industry, as a globally-connected energy sector. Questions of visibility are again evident, as the selection of sites determines who is 'given voice', and who is silenced. Consideration of sites forces a theorisation of power relations; it also forces researchers to recognise the politics of their research as they encounter resistance from power-holders. Michel [29] offers an illustration of how ethnography can encompass the exclusions and silences that serve fossil fuel extraction. Forces for extraction are interpreted as an overarching social-ecological 'cyborg', encompassing corporate structures, automated labour, governmental frameworks and excluded communities, accessed through ethnographic engagement. The cyborg benefits institutional players beyond the region, while locking-in local social exclusions. Walton [30] also addresses energy culture, but 'from above', in terms of financiers based in large foundations. Drawing on psychology and sociology the paper explores how fund managers can overcome institutional addiction to carbon-intensive investments, and change their behaviour through an emergent reward structure for 'negative deviance'. Muftuoglu et al. [31] also focus on the problems of 'studying up', in their experience of researching the culture of energy corporations. They focus on the corporate social responsibility commitments of Norwegian energy companies, and how they are manifested in practice, both internally and on the ground, in Turkey, Tanzania and Norway itself. Their approach reflexively balances critique and access, revealing strategic dilemmas in terms of the politics of energy research.

2.5. Theme 5: comparative and multilevel studies

Climate change is a global process with hugely uneven drivers and consequences, yet climate and energy policy are primarily nationally-defined, articulated at the international level. As a consequence, comparison of climate and energy policy across national or local contexts and between levels of authority can offer theoretically-rich insights into the process of energy transition. Several papers in the Special Issue address this issue of comparison and its possibilities. Ylä-Anttila et al. [32] reflect on the methodological benefits and challenges of constructing a large cross-national research agenda comparing national climate policy networks using a range of sources and methods (COMPON). With more than 20 countries and dozens of researchers enlisted to the effort, over a decade or more, the comparison offers

multiple insights into the policy-making process. Achieving comparable qualitative datasets, and marshalling results into causal explanations proved to be most challenging. Explaining unevenness is a key issue; Ryder [33] explores energy injustice, and how to overcome it, using re-distribution. As such, Ryder shows how researching energy justice requires both a multi-scalar and intersectional approach. The unevenness of climate change, in terms of cause, effect and impact, is addressed through multilevel structures, principally defined in terms of national responsibilities. Ryder shows how the problem is much deeper, re-flecting intra-national and global socio-cultural stratification, creating the need for scaled and intersectional approaches that address the un-even responsibility and vulnerability. Several other articles use com-parison to develop models for energy transition. Like Sahakian and Bertho [18] (theme 2) Outcault et al. [34], address household energy use, bridging psychology and sociology to focus on interpersonal en-gagement and sociality at the household level; their model is com-parative, centred on the use of air cooling across contrasting cases in the US and Japan, to illustrate the kinds of insights their awareness of problems with method can deliver. Sarrica et al. [35] find common themes in developing community-level renewables across contrasting contexts. They emphasise the importance of a local-level research frame, to document the growing visibility of energy, and related dy-namics of social ownership, participation and democratisation – while being aware of the difficulties of transferring methods and knowledge across fields. Kesidou and Sorrell [36] focus on buildings, discussing the practical barriers to low-carbon construction. They address the in-dustry's method of 'supply chain integration', finding it inadequate given diverse needs; instead, they favour more comprehensive policy instruments, preferably defined at sector level by national regulatory bodies. Jensen et al. [37] address questions of how to analyse large-scale 'big data' for more than a thousand energy efficiency and re-newable projects, mapped over time, in the EU. The paper reflects on the difficulties in establishing a thematic classification of the projects, across thirty categories, which at the same time retains their specific social content and context.

2.6. Theme 6: temporal and longitudinal studies

Climate change re-scales conceptions of time, for instance in terms of defining horizons for radical disruption, reconfiguring relations with future generations, and reordering present-day priorities. Energy policy is placed in the trajectory of emissions reduction, and potentially sub-sumed by it. Several papers reflect on how to address these temporal dimensions of climate and energy policy. Smith et al. [38] offer insights into conducting a longitudinal study of a wind power plant, before during and after construction, tracking changing community responses over time. They show how research engagement can be cumulative over time: they move iteratively to deeper forms of analysis, from media analysis, to ethnographic participation, to stakeholder focus groups, enabling participants to 'make meaning' of the descriptive data. Through data-mining, Benites-Lazaro et al. [39] analyse public re-sponses to national energy policy over time, focusing on public debate over biofuels in Brazil; data was mapped over a decade and used to highlight trade-offs between food, water and energy concerns. Like Ylä-Anttila et al. [32], Edling and Danks [40] show how cross-national and longitudinal research can shed light on influencing energy transition, in this case to wood fires. The linkages between macro-level systemic changes and local-level energy use are especially highlighted, as is the problem of 'pro-innovation' bias in energy transition research; in-vestigating reasons for non-adoption of renewable energy may be cri-tical. Goodman [41] discusses possibilities and problems of ethno-graphy, showing how a specific 'climate ethnography' has emerged over time, normatively dedicated to decarbonisation. Ethnographers are not immune to the growing apprehension of climate change, and the field reflects a growing normative desire to address socio-cultural barriers to required energy transitions. Goodman shows how studies of climate

impacts are increasingly shifting to investigations of agency and con-testation, whether played out in a particular locality or across institu-tional sites, for instance along the fossil fuel commodity chain.

2.7. Theme 7: participatory and action research

Most if not all of the papers in the Special Issue arise from a nor-mative commitment to reconciling climate and ecological crisis with energy policy. Several papers integrate the outcome of research into its process and method: for some this translates into on-the-ground parti-cipatory research, directed at energy planning and sustainabilities. Ghosh [42] addresses some of the ethical dilemmas and risks that arise from engagement with research collaborators in 'the field', especially in terms of the security risks. Energy transitions can be highly politicised, with on-the-ground contestation of fossil fuels violently resisted by the authorities (and others). Ghosh reflects on what may be necessary to miminise the risks for people in the field and the researcher, the re-sulting impacts on the research process, and on what may and may not be gathered as research data. Gailing and Naumann [43] for instance demonstrate how focus groups can be both participatory and delib-erative. They show how focus groups require considerable preparation to be worthwhile, and generate a great deal of data for analysis; when not treated as simply a series of interviews, they can generate important insights into dialogic interaction and can themselves shift power rela-tions on the ground. Likewise, Thomas et al. [44] compare the effec-tiveness of community participatory energy planning in the US and the UK. The projects centre on community role-play, where participants in focus groups take on the role of local representatives charged with grappling with pros and cons of different energy scenarios. The studies produce fresh and engaging commentary from the participants, in-cluding discussion and criticism of the method itself, allowing the au-thors to address challenges that emerged as voiced by participants. Siegner [45] takes action research further in the 'the field', with a comparison of high-school climate and energy education programs in the US. Here the research is directly used to review and revise the programs for more effective 'outreach' strategies for climate literacy (Picture 3).

3. Exploring problems in method

Looking across the collection as a whole, and reflecting on our own experience, we have identified several cross-cutting problems of method and situation: first, climate change as an emergent process; second the problem of context; third the problem of 'many layers'; fourth issues of comparison; fifth the problem of politics; sixth multi-disciplinarity; seventh the prime issue of socialising climate, with which we began.

3.1. Climate change as an emergent process

Climate change, while driven by the accumulation of greenhouse gas emissions in the atmosphere is not cyclical nor consistently smooth; it is probably a 'non-linear change' with multiple tipping points, changing all the systems being observed [46]. Consequently, today's proposed solutions can very quickly become tomorrow's failures. As the climate problem accelerates, anticipatory action is out-paced. Attempts at addressing climate change have already created a lineage of policy wreckage left in the wake of a growing and unmanageable biophysical crisis. All potential solutions face this problem, but predictably, many climate policy measures seem pursued to avoid transition from the extraction and burning of fossil fuels, such as; voluntary abatement, carbon capture and storage, emissions intensity measures, 'clean de-velopment' projects, emissions trading, carbon offsets, carbon sinks, land use offsets, forest and soil carbon abatement – and this list is not exhaustive. All are, almost by definition, inadequate to the task of permanently sequestering 'unburnable carbon'. Research revealing such

Picture 3. 'Steam rises from cooling towers, Germany' Image Credit Lothar Michael Peter.

policies to be out of date before they are enacted, provokes hostility from established powers, and those who perceive themselves as benefitting from, associated with, or fearful of losing the status quo (in possibly quite different ways). In a cumulating non-linear crisis, these questions of time become critical. In many respects, climate change reconfigures our perception of time, across past and future generations, and as Chakrabarty affirms [9], this could be a key aspect of its disruptive and vertiginous effect.

As is clear, not least from successive IPCC reports, researchers are not researching a fixed or stable process, they are researching an emergent process, which may be predictable in terms of trends but largely unpredictable in detail. We can, for example, predict that average temperatures will continue to climb for the foreseeable future largely due to the already present accumulation of CO_2 and methane, and that this will likely produce 'climate turmoil', but we cannot predict the weather in a particular place in a year's time with any certainty, especially given that the system is changing. The same is true for social systems, where making predictions is even more complicated. People can predict a cycle of booms and busts in the capitalist economy, but not when, in what area, nor how long they will last. Neither can we assume that politics is about applying transparent interests. Just because some action might benefit the dominant classes, does not mean that class will take that action, that the results will be as they may intend, or that alliances will remain stable as the situation becomes more chaotic. Similarly, we cannot default to assuming that social behaviour is functionally adaptive, it may be maladaptive or even make the situation worse. Within this framing it also becomes important to

consider 'tipping points', with the accumulation of small changes leading to massive transformation and 'long tails' in which rare events have more important consequences than regular events. This implies our methods might have to look at unusual events and social failures as much as we look at regularities and similarities. The distinction between trend, event and irruption, seems to be an important constraint for research, which leads to significant problems of method–especially as all explanatory models are necessarily simplifications. Yet such theories only become more urgent as the challenges accumulate.

3.2. Methods, solutions and contexts

Social context becomes vital to method and action, as some solutions may not work in different social contexts. For example a vital technology (such as greenhouse gas removal) may not work in a neoliberal capitalist context as there is little profit to be made, or may be transformed into something (such as oil recovery) which helps produce more greenhouse gases. Potential solutions need to be examined for their unintended consequences as they come into play, as when biofuels seem to produce further deforestation, removal of people from land, loss of self-sufficiency, and increase in the prices of food [39]. Solutions, or even methods, which help one group of people, have the possibility of disrupting others [23]. Again, the problems create dilemmas: can we treat research as a constant set of movements, problems with method, producing greater refinement and understanding, that uncover unintended consequences, while still retain a capacity to act?

3.3. The problem of "many layers"

As we have suggested, different systems interpenetrate each other, and it is self-evidently difficult to isolate local system-events from larger scale system-events and vice-versa. Such systems have fuzzy or indistinct boundaries, they are 'multilayered' and affect and disrupt each other in what may be found to be unexpected ways. World level forces (whether ecological, climate or social) have an impact on local communities, and local communities can have an impact on world events. Indeed some theories of social power and 'innovation' imply that system innovations can occur in areas that are to some extent remote from the ordering effects of social power. Although they may be hard to perceive these new movements can evolve and spread elsewhere. However, as they are hard to perceive they are also hard to research, as for instance demonstrated by Michel [29]. Sarrica et al. [35] also point out that in the emerging 'sustainable energy' paradigm based on small-scale infrastructures and short supply chains "the local dimension is pivotal" and that local communities can be "an indispensable support in the construction of shared understandings of a given problem." We cannot always assume that 'big' processes are the only important processes. However, while change may come from marginal places, or places of 'interstitial emergence' [47]: 161–7, it is also likely that corporate and governmental elites can accelerate and coordinate changes in social behaviours, and this needs study especially in a global context.

3.4. Comparison and context

Findings in one particular place may have to be compared with findings from other places to discover how general those findings are. Many ethnographers have pointed out that traditional bounded and small ethnographic sites are unrealistic in contemporary conditions, calling for multi-sited ethnography and ethnography which traverses boundaries, or which recognises the effects of 'external' systems, as we are always within widespread systems [41]. Conversely, macro modes of researching have to be reconciled with the particularities of place-based context, or we may miss part of the dynamics at either level [37]. So the paradox is set: both high intensity local ethnography and multi-sited or multi-scalar ethnographies can limit what will be learned. The

necessity of exploring events over large areas, challenges conventional ideas of the field site, while choices in limiting the research field influence the research process, but even limited sites might be quite fractured by external forces. Certainly research has to become more comparative, perhaps not in the manner of grand theory in which everything can reduced to the one dynamic, but in a way in which differences are attended to with as much care as similarities [35], Walsh et al., this issue, [32]. Using local studies from outside (or even inside) the research team may lead to problems as the different researchers almost certainly did not look at quite the same processes, or document them in the same way, or because the different societies have units not comparable in the same way, or when events which appear similar actually have radically different meanings, due to differing contexts.

Contextualisation requires engagement with experience, action and meaning. Ethnographers specifically aim to access such experience, and the meaning it generates [28,41]. Traditionally, the only way to approach understanding of what people are doing, why they do it and what they ignore doing, is through living with those people and sharing in their activities. The sharing helps ground the theorist in practical activity and helps give reference to the purpose of what people are doing, their feelings, habits, expectations and techniques. It gives a sense of why people may do things that appear harmful to the outside observer. It allows the participant to become aware of what people actually do, as opposed to what they say they do, or think they do. However, ethnography presents a risk of the researcher being 'captured' by key (and interesting) informants, who can influence what the ethnographer perceives, how they interpret, who they interact with and how they are placed by others. There is a chance that research will further silence marginal voices, if an effort is not made to discover the patterns of social enforcement of silence [28,15,35].

3.5. Research and politics

Because the problems of energy and climate go everywhere, we may need to study up, down and sideways [28]. 'Studying up' or looking at elites presents research with problems, in terms of access and manipulation of data [31], Walsh et al., this issue, [32]. Researching hierarchies creates ethical difficulties about revealing the 'facts' concealed, as well as the risk of legal challenge or suppression. Authority may also limit what, or who, can be studied; as Espig and de Rijke [28] write, "aspects of secrecy and restriction are themselves revealing of the energy research field". Close engagement with social contexts and meanings, through participation and observation, can clearly make the researcher more aware of disjunctions and fine variations in social life, though this nuance may undermine capacity to articulate compelling grounds for change. Yet again, it is clear that quantitative methods can be useful, and add a structure to the subjectivity, if sampling frames are carefully chosen, and non-response is not ignored [14].

There are the perennial problems of how to relate to 'the field', sharpened by the normative and politicised context. Fieldwork of all sorts alters the situation being observed, and this needs to be accounted-for. A questionnaire for instance may force people to think about things they would not normally think about, pose questions which cannot be answered with the options allowed, and lead people to answer in novel and maybe distorted ways. In some cases the observers may heighten risks for participants, although not being there heightens risks in different ways [42]. Investigators may hope that their presence helps the people being observed to deal with the problems they face, but again opens the possibility of risk and blame. What happens when the researchers leave? Whose sponsorships and intentions (in the field) has the research become tied to? [26]. How open is the method to intervention from those being researched? [44]. Where transformation of the field is the purpose of the research, as with action research, how can that change be secured? [43].

Even with close engagement there is the problem of accuracy. Information may primarily have a tactical purpose in a political

struggle, or be part of an obfuscatory attempt at cultivating technicised expert authority and public 'ignorance' of unintended consequences. Research potentially reveals disinformation or misunderstanding, and can change the situation. Interviewees can self-censor, there can be restrictions on who can be approached for information, and there may be requirements for non-disclosure [28]. Influential organisations can be hostile to research on themselves. Politics means that people with influence may try to affect the results of research, or replicate the official line, or the research can be impacted by the same distorting processes acting in the field [21]. Research (and researchers) can also become captured by capitalist hype of new products or new modes of organisation (which are not quite they are claimed to be). Competition for limited funds can distort agendas – not only for companies seeking to persuade investors to invest in their visions, but for researchers seeking support and recognition for research, as funder fashions change. In a politicised context, even straightforward empirical research can generate dangers for researchers themselves, such as having to confront attempts at surveillance and threat as social actors invested in the status quo try to reinforce the ongoing conditions. Revealing the actions of those resisting authority can increase their vulnerability [42]. All this adds to uncertainty, which needs to be factored into the analysis, with the caveat that public uncertainty can itself be mobilised as a common political manoeuvre. This includes uncertainty of consequences, of predictability, of even the range of data that is relevant.

3.6. The question of multi-disciplinarity

A recurring insight of this Special Issue is that understanding the social-ecological-energy crisis cannot be confined to one discipline, one place, or one technology. As such, study is not easily bounded. There is no sociology without psychology, without economics, without physics, without biology, without ecology, and so on. Fruitful analysis may be forced to become what is known as 'transdisciplinary', 'interdisciplinary' or 'multi-method'. This then leads to a whole series of questions and problems. Given the possible multiplicity of factors, we may wonder if single discipline analyses and methods can still provide useful insights? If we need multiple disciplines, then how incommensurable are those different disciplines? Can it possibly be enough to take a purely sociological approach when, for example, we have to understand the relations of society to ecology and the workings of ecologies, as well as understand the dynamics of group and individual psychology, communication processes in times of stress, and the physical workings of technology? How can people in different disciplines exchange relevant information or invent coherent and transferable theories? How do researchers recognise quality within other disciplines? Does collaboration across disciplines produce difficulties of integrating different types of theory with supposedly different objects and methods of research? How do different methods interact, conflict with each other and transform each other? How do we make different methods commensurable? Can the tools and methods that allow people to describe how one type of system works, always allow them to describe or understand how other systems work? What other benefits, or difficulties, accrue from working across boundaries, or recognising that boundaries are likely to be fuzzy and vague, especially when geographical boundaries seem under constant challenge from global anthropocenic processes?

Several papers in the Special Issue explicitly grapple with these problems. Sahakian and Bertho [18] for instance explore emotional factors and the difficulties of accessing these, as a way of registering social tensions ("cracks in the walls of normative practices") and difficulties. King et al. [23] show the importance of including soil science in studies, despite differences in research interests and methodological approaches, while Zaunbrecher et al. [19] discuss the difficulties of combining both ecological and social assessment of energy supply options and conveying information from one public sector to another. Zaunbrecher et al. also specifically mention what they call the

Picture 4. 'Solar and wind power: Lusatia, Germany.' Image Credit Lothar Michael Peter.

"oversimplification problem" which arises whenever people in one discipline have a detailed description of their own problem space together with an oversimplified description of the connected discipline, for example when "the ecological consequences are reduced to one parameter (*e.g.*, impact on birds)."

3.7. Problems of socialising climate

'Good' theory, of course, is one that gains purchase in everyday contexts. This brings us back to the overarching question of socialising climate. Climate change by definition is abstract and remote – even if directly experienced its causes and solutions are far removed from everyday life, and from the capacity to act. People may not be aware of climate change impacts or its causes, or not find it useful in addressing their immediate eco-social problems. 'The science' and its predictions may not appear intertwined with daily life or understanding. Indeed it seems common for people to reject 'science' when it challenges their worldviews, and conflicts with the regularity of daily life [17]. Protestations of 'objectivity' from scientists may potentially render them outsiders, problematize their responses for others, or accommodate powerful interests [17,23]. Science, including social science, may appear an elite, or foreign, activity, removed from local concerns, especially if 'the solution' involves people being 'encouraged' to move, or suffer disruption while others do not [20].

Irrespective of this lack of local resonance, the facts and trends of climate change may still generate an ongoing background of systemic social change, disruption, exploitation or injustice, which may need to be brought into the everyday cultural discourse, so that societies can deal with the challenges they face. While researchers cannot necessarily assume they can find a common framework of understanding which will work everywhere, somehow these frameworks have to be brought together in fruitful collision. The situations demand that such research become multi-disciplinary, transdisciplinary, mixed method, local and general, even at the risk of failing to understand or integrate the

different fields successfully. For it to be of use to local people, it also has to become phrased in meaningful ways for local action. Context needs to be seen as a platform, not as a problem to be overcome or to be framed as 'obstacles' or 'ignorances' which need correction from outside. Framing and context is important, as are the politics of reporting or transmitting ever-changing results and theories, which constitutes another problem for researchers – this is research we want to be read, to be useful and to be seen as reliable.

Finally, the more interdisciplinary approach can lead to problems of policy. The move to more holistic approaches can possibly negate the capacity to act. If all fields/processes interact with and modify each other, in ever-more complex iterations, resisting explanation and strict causality, they may prevent simple agency. Here, ironically, the very process of inquiry can create intellectual stasis, and become counterproductive. This is a concern for many contributors in this Special Issue. Generally they embrace the dilemmas this produces, arguing for the capacity to act. No matter how tightly defined, the theory and understanding of an issue and policy field has to be open to unintended and unexpected events, and at least to speculation as to how they may emerge, especially as people respond to the changed circumstances (Picture 4).

4. Conclusion: from dogmatism to dialogue?

We started this introduction by promising a discussion of the cross-cutting problems social research into energy and climate might face and, despite those problems, the necessity for socialising climate and energy, as part of a necessary move to generate solutions for climate change. We have listed and discussed some of these recurring problems, in the hope of making them explicit and open to challenge. However, while explicit, the problems remain complex because none of them can be treated in isolation: they are (as we said) 'cross-cutting' and interactive, modifying each other and are subtly different in different contexts. This interaction and difference perhaps cannot be eliminated or

simplified, which makes problems of method central for this field. Every piece of research has the potential to contribute something new or disruptive. Researchers can be self-reflexively aware of their methods, especially the importance of method in determining what data is uncovered or neglected, In this way, recurrent attention to the problems of method and methodology, can becomes a 'teaching' moment, deepening our perspective on the substantive problems at hand.

In the social sciences it has seemed that while proposing problems with other people's methods is common, investigating the problems with our own methods is rare. Even doing a little subjective research it can easily appear that most methodological articles are methodological defences, framed by attacks on alternate methods. While these articles are interesting and often valuable, we hoped that with this issue we could stimulate people to think about the problems they faced with, or with finding, their own method, and the ways that the methods' interaction with the resistant nature of reality, caused problems, and what we can learn from those problems. We hoped to allow people to talk about problems faced in their own research helping to normalise this, and make it a process that people could happily learn from. In the main we believe this has been achieved, although we notice the general tendency, including for ourselves, of defaulting to defence and post-hoc rationalisation.

Despite the problems of multi- or trans- disciplinary research, the contributions report on many instances of correlation across approaches, bridging the methodological assumptions embedded in disciplines. Correlation, though, is generally presented as relatively harmonious, relatively seamless, and successful. We can compare approaches across articles, as outlined in this introduction, but this has its limitations. One contribution, from Morton and Mueller [22], models a more explicitly dialogic approach founded on disagreement. Here, the creative tensions, in a mode of response and counter-response, allow reflection on the experience of collaboration, and offer a particularly rich exploration of the problems, *in situ.* This kind of approach, as a dialogue across disagreement, may offer the most fruitful avenue for future investigations, which we hope could follow from this initial series of explorations. Again we can restate, that reflections on method do not seem incidental to the problems we face in socialising climate and solving the problems of climate and energy.

Acknowledgement

References

[1] E. Babbie, The Practice of Social Research, 14th ed., Cengage Learning, Boston, 2016.
[2] T. Kuhn, The Structure of Scientific Revolutions, University of Chicago Press, Chicago, 1962.
[3] M. Hulme, Mapping climate knowledge: an editorial essay, Wiley Interdiscip. Rev. Clim. Change 1 (1) (2010) 1–8.
[4] J. O'Connor, Natural Causes: Essays in Ecological Marxism, Guilford Press, New York, 1997.
[5] IEA, International Energy Agency, Energy and climate change, World Energy Outlook Special Report, IEA, Paris, 2015.
[6] J. Moore, Capitalism in the Web of Life: Ecology and the Accumulation of Capital, Verso, London, 2015.
[7] D. Haraway, Staying with the Trouble: Making Kin in the Chthulucene, Duke University Press, Durham, US, 2016.
[8] J. Parikka, The Anthrobscene, University of Minnesota Press, Minneapolis, US, 2014.
[9] D. Chakrabarty, The climate of history: four theses, Crit. Inq. 35 (2008) 197–222.
[10] C. Wright Mills, The Sociological Imagination, Oxford University Press, New York, 1959.
[11] A. Salleh, J. Goodman, H. Hosseini, From sociological imagination to "ecological imagination": another future is possible, in: J. Marshall, L. Connor (Eds.), Environmental Change and the World's Futures: Ecologies, Ontologies, Mythologies, Routledge, London, 2016.
[12] B. Sovacool, What are we doing here? Analyzing fifteen years of energy scholarship and proposing a social science research agenda, Energy Res. Soc. Sci. 1 (2014) 1–29.
[13] A. Stirling, Transforming power: social science and the politics of energy, Energy Res. Soc. Sci. 1 (2014) 83–95.
[14] B. Sovacool, J. Axsen, S. Sorrell, Promoting novelty, rigor, and style in energy social science: towards codes of practice for appropriate methods and research design, Energy Res. Soc. Sci. 45 (This issue).
[15] S. Glueck, Making energy cultures visible through situational analysis, Energy Res. Soc. Sci. 45 (This issue).
[16] J. Walker, M. Johnson, On mineral sovereignty: towards a political theory of geological power, Energy Res. Soc. Sci. 45 (This issue).
[17] M. Edwards, "Just Report the Science": How scientists frame their engagement in contested debates over fracking in the Barnett Shale, Energy Res. Soc. Sci. 45 (This issue).
[18] M. Sahakian, B. Bertho, Exploring emotions and norms around Swiss household energy usage: when methods inform understandings of the social, Energy Res. Soc. Sci. 45 (This issue).
[19] B. Zaunbrecher, B. Daniels, M. Roß-Nickoll, M. Ziefle, The social and ecological footprint of renewable power generation plants. Balancing social requirements and ecological impacts in an integrated approach, Energy Res. Soc. Sci. 45 (This issue).
[20] D. Nash, P. Memmott, J. Reser, S. Suliman, "We're the same as the Inuit!": exploring Australian aboriginal perceptions of climate change in a multidisciplinary mixed methods study, Energy Res. Soc. Sci. 45 (This issue).
[21] J.P. Marshall, Psycho-social disruption, information disorder and the politics of wind farming, Energy Res. Soc. Sci. 45 (This issue).
[22] T. Morton, K. Mueller, At the German coalface: interdisciplinary collaboration between anthropology and journalism, Energy Res. Soc. Sci. 45 (This issue).
[23] J. King, C. Granjou, F. Fournil, L. Cécillon, Soil sciences and the 4 per 1000 Initiative–the promises of underground carbon, Energy Res. Soc. Sci. 45 (This issue).
[24] E. Heaslip, F. Fahy, Developing transdisciplinary approaches to community energy transitions: an island case study, Energy Res. Soc. Sci. 45 (This issue).
[25] P. Scherhaufer, S. Höltinger, B. Salak, T. Schauppenlehner, J. Schmidt, A participatory integrated assessment of the social acceptance of wind energy, Energy Res. Soc. Sci. 45 (This issue).
[26] M. Montedonico, F. Herrera-Neira, A. Marconi, A. Urquiza, R. Palma-Behnke, Co-construction of energy solutions: lessons learned from experiences in Chile, Energy Res. Soc. Sci. 45 (This issue).
[27] S. Thomas, M. Richter, W. Lestari, S. Prabawaningtyas, Y. Anggoro, I. Kuntoadji, Transdisciplinary research methods in community energy development and governance in Indonesia: insights for sustainability science, Energy Res. Soc. Sci. 45 (This issue).
[28] J. Espig, K. de Rijke, K. Energy, Anthropology and ethnography: on the challenges of studying unconventional gas developments in Australia, Energy Res. Soc. Sci. 45 (This issue).
[29] T. Michel, The lifeblood of the cyborg: or, the shared organism of a modern energy corporation and a small Northern Territory town, Energy Res. Soc. Sci. 45 (This issue).
[30] A. Walton, Positive deviance and behaviour change: a research methods approach for understanding fossil fuel divestment, Energy Res. Soc. Sci. 45 (This issue).
[31] I. Muftuoglu, S. Knudsen, R. Dale, O. Eiken, R. Dinah, S. Lange, Rethinking access. Key methodological challenges in studying energy companies, Energy Res. Soc. Sci. 45 (This issue).
[32] T Ylä-Anttila, A. Gronow, M. Stoddart, J. Broadbent, V. Schneider, D. Tindall, Climate Change policy networks: why and how to compare them across countries, Energy Res. Soc. Sci. 45 (This issue).
[33] S. Ryder, Developing an intersectionally-informed, multi-sited, critical policy ethnography to examine power and procedural justice in multiscalar energy and climate change decisionmaking processes, Energy Res. Soc. Sci. 45 (This issue).
[34] S. Outcault, A. Sanguinetti, M. Pritoni, Using social dynamics to explain uptake in energy saving measures: lessons from space conditioning interventions in Japan and California, Energy Res. Soc. Sci. 45 (This issue).
[35] M. Sarrica, M. Richter, S. Thomas, I. Graham, B. Mazzara, Social approaches to energy transition cases in rural Italy, Indonesia and Australia: iterative methodologies and participatory epistemologies, Energy Res. Soc. Sci. 45 (This issue).
[36] S. Kesidou, S. Sorrell, Low-carbon innovation in non-domestic buildings: the importance of supply chain integration, Energy Res. Soc. Sci. 45 (This issue).
[37] C. Jensen, G. Goggins, F. Fahy, E. Grealis, A. Vadovics, A. Genus, H. Rau, Towards a practice-theoretical classification of sustainable energy consumption initiatives: insights from social scientific energy research in 30 European countries, Energy Res. Soc. Sci. 45 (This issue).
[38] H. Smith, T. Smythe, A. Moore, B. Bidwell, J. McCann, The social dynamics of turbine tourism and recreation: introducing a mixed-method approach to the study of the first U.S. offshore wind farm, Energy Res. Soc. Sci. 45 (This issue).
[39] L. Benites-Lazaro, L. Giatti, A. Giarolla, K. Kato, Topic modeling method for analyzing social actor discourses on climate change- energy and food security, Energy Res. Soc. Sci. 45 (This issue).
[40] L. Edling, C. Danks, To adopt or not to adopt? That was our question: insights on energy transitions from a study of advanced wood heating, Energy Res. Soc. Sci. 45 (This issue).
[41] J. Goodman, Researching climate crisis and energy transitions: issues for ethnography, Energy Res. Soc. Sci. 45 (This issue).
[42] D. Ghosh, Risky fieldwork: The problems of ethics in the field, Energy Res. Soc. Sci. 45 (This issue).
[43] L. Gailing, M. Naumann, Using focus groups to study energy transitions: researching or producing new social realities? Energy Res. Soc. Sci. 45 (This issue).

[44] M.J. Thomas, T. Partridge, F. Pidgeon, B. Harthorn, C. Demski, A. Hassell, Using role play to explore energy perceptions in the United States and United Kingdom, Energy Res. Soc. Sci. 45.

[45] A. Siegner, Experiential climate change education: challenges of conducting mixed-methods, interdisciplinary research in San Juan Islands, WA and Oakland, CA, Energy Res. Soc. Sci. 45 (This issue).

[46] F. Incropera, Climate Change: A Wicked Problem, Cambridge University Press, 2015.

[47] M. Mann, The Sources of Social Power vol. 1, Cambridge University Press, Cambridge, 1986.

[48] N. Bhushan, Studying the effects of intervention programmes on household energy saving behaviours using graphical causal models, Energy Res. Soc. Sci. 45 (This issue).